

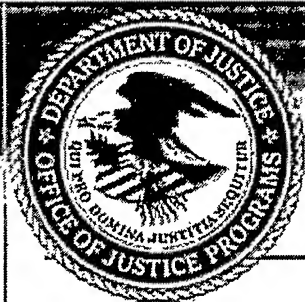
U.S. Department of Justice
Office of Justice Programs

The National Institute of Justice

**Aviation Technologies
Program: UAS Specific**

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Thank You



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National Institute of Justice

NIJ

Office of Science and Technology

manages:



- Technology Research and Development
- Demonstrations, evaluations, transfer and adoption of new and emerging technologies.
- Development of technology guides, standards, and test reports
- Operational tests and evaluations
- Forensic sciences capacity building programs
- Technology assistance to Federal, State, and local criminal justice and public safety agencies



OST Technology Portfolio

Aviation

Biometrics

Body Armor

Communications Tech

Corrections (Institutional
Community)

Court Technology

DNA Forensics

Electronic Crime



Explosives Detection and
Remediation

General Forensics

Geospatial Technologies

Information Led Policing

Less Lethal Technologies

Personal Protective Equipment

Pursuit Management

School Safety

Sensors and Surveillance

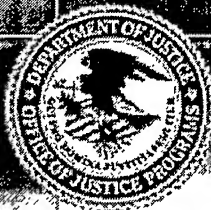
Just About Any Public Safety Technology Area!



Aviation Technology Program



Our Aviation Technology program was established to evaluate the efficacy, affordability and frequency of utilization of various aviation assets for smaller and predominately rural law enforcement agencies across the United States.



Law Enforcement Aviation Technology Program

Goal: NIJ's Aviation Technology program was established to evaluate the efficacy, affordability and frequency of utilization of various aviation assets and associated technologies for smaller and predominately rural law enforcement agencies across the United States.

Statement of Need: Numerous public safety and State and local officials have expressed a need to deploy low-cost and safe aviation assets for cannabis field detection and illegal remote narcotic lab detection; as a search tool for search and rescue missions; aerial photography/surveillance of critical infrastructure; border patrol; traffic; special events and to provide overall support to Joint Police Operations.

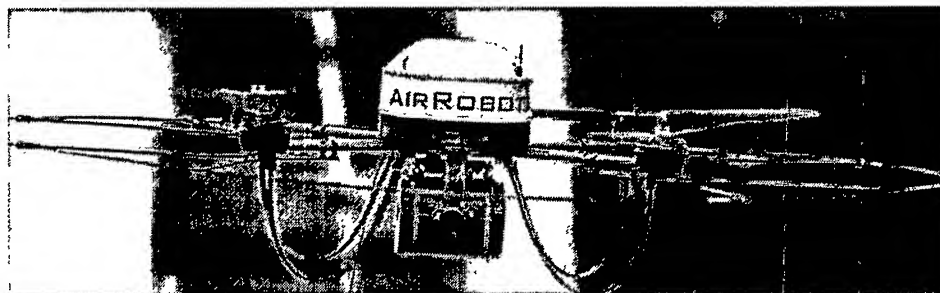
Key Thrusts:

- Continue operational evaluation of various aviation assets.
- Continue the work on a best practice guide for aviation technology implementation in an operational setting.
- Continue to investigate and analyze emerging aviation technologies.
- Continue the work with the FAA on law enforcement guidelines for the safe and lawful use of Unmanned Aircraft Systems (UAS).
- Continue the work on a quick deployable, low-cost and safe to use aircraft camera system.
- Stand-up a Technical Working Group from interested public safety aviation experts.
- Conduct aviation technology demonstration day(s) for public safety and other interested parties.
- Continue outreach efforts to better educate law enforcement officers on issues such as federal restrictions on the use of UAS and safety issues related to public safety aviation technologies.



Identify Public Safety Requirements

- **Project Description:** Funding will provide support for the Aviation Technology Technical Working Group (TWG).
- **Deliverables & Schedule:** Bi-Annual TWG meetings and the reporting back of recommendations and priorities.
- **Partners:** Federal, State and Local Law Enforcement, National Law Enforcement Associations, Other Federal Agencies and Interested Parties.



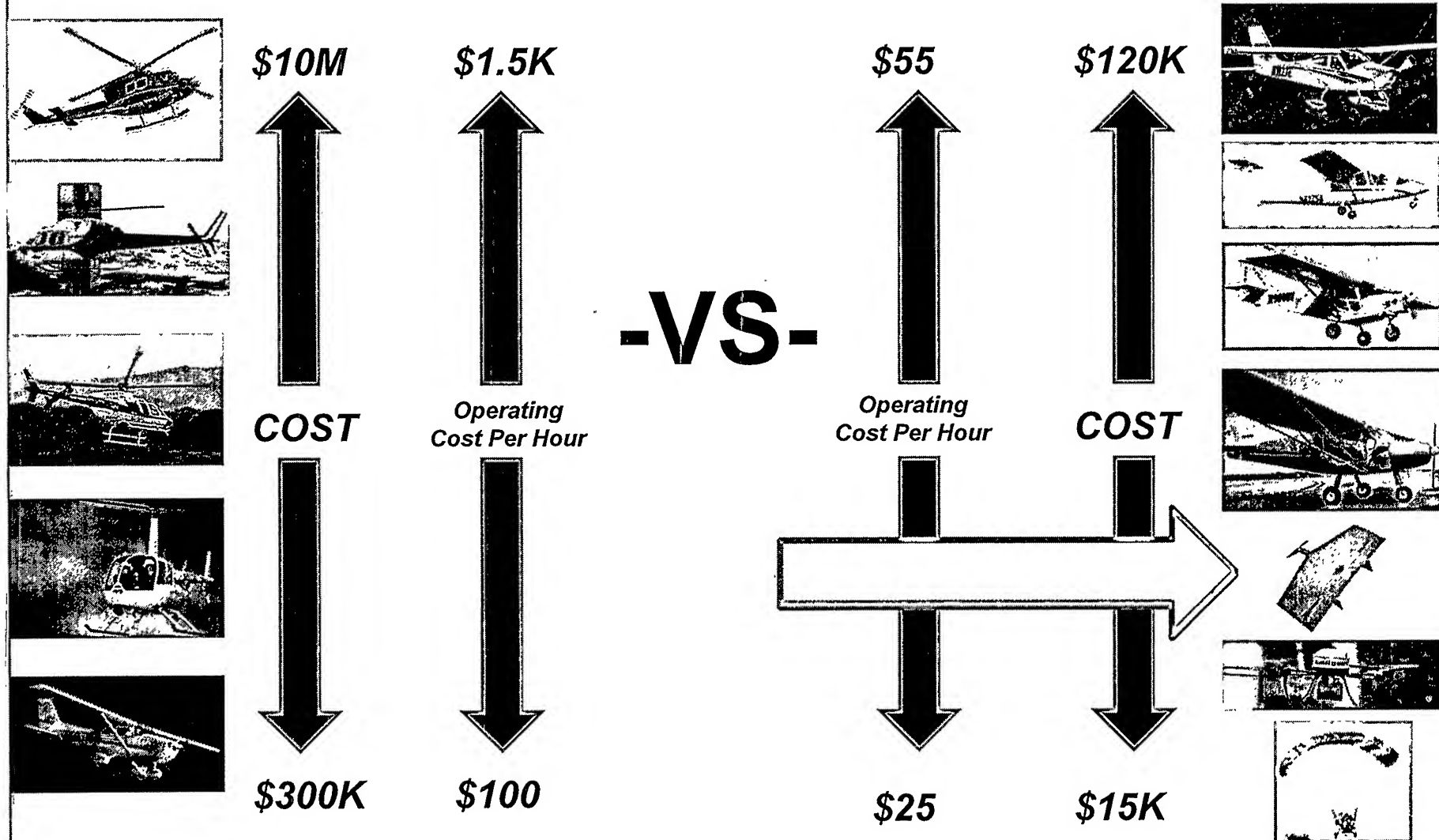


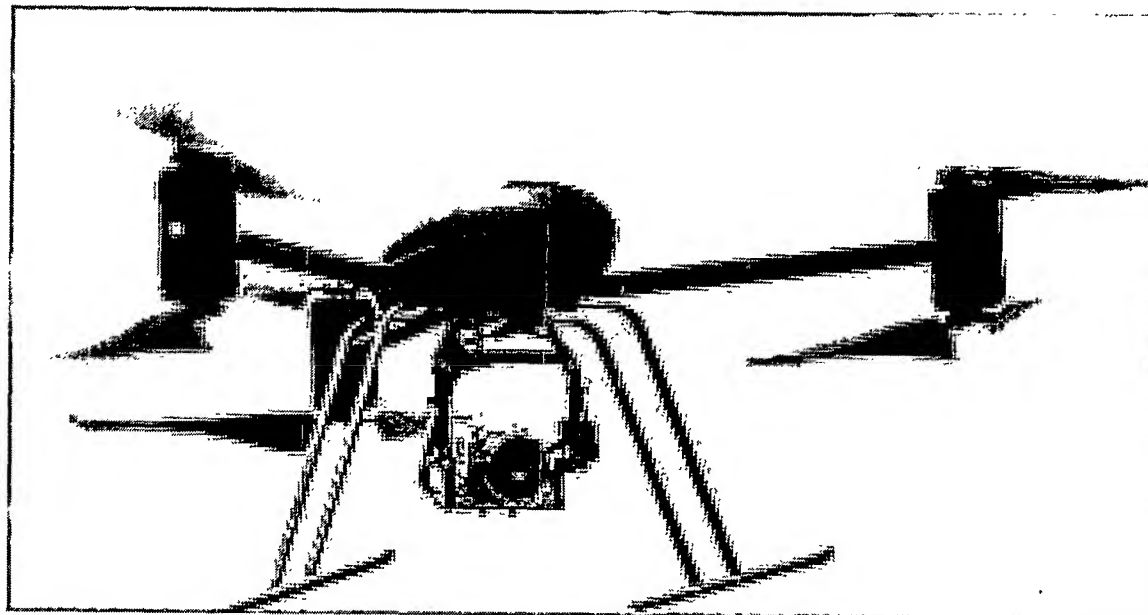
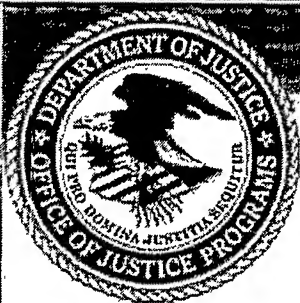
Numbers and Customers

- **19,000 Agencies**
- **Less than 300 Agencies with Aviation Units**
- **Average agency (75%) has 25 or fewer Officers**
- **Budgets are extremely Tight**
- **Mission Must Drive the Technology**
- **Technology Should have High Return on Investment**



Economy of Scale



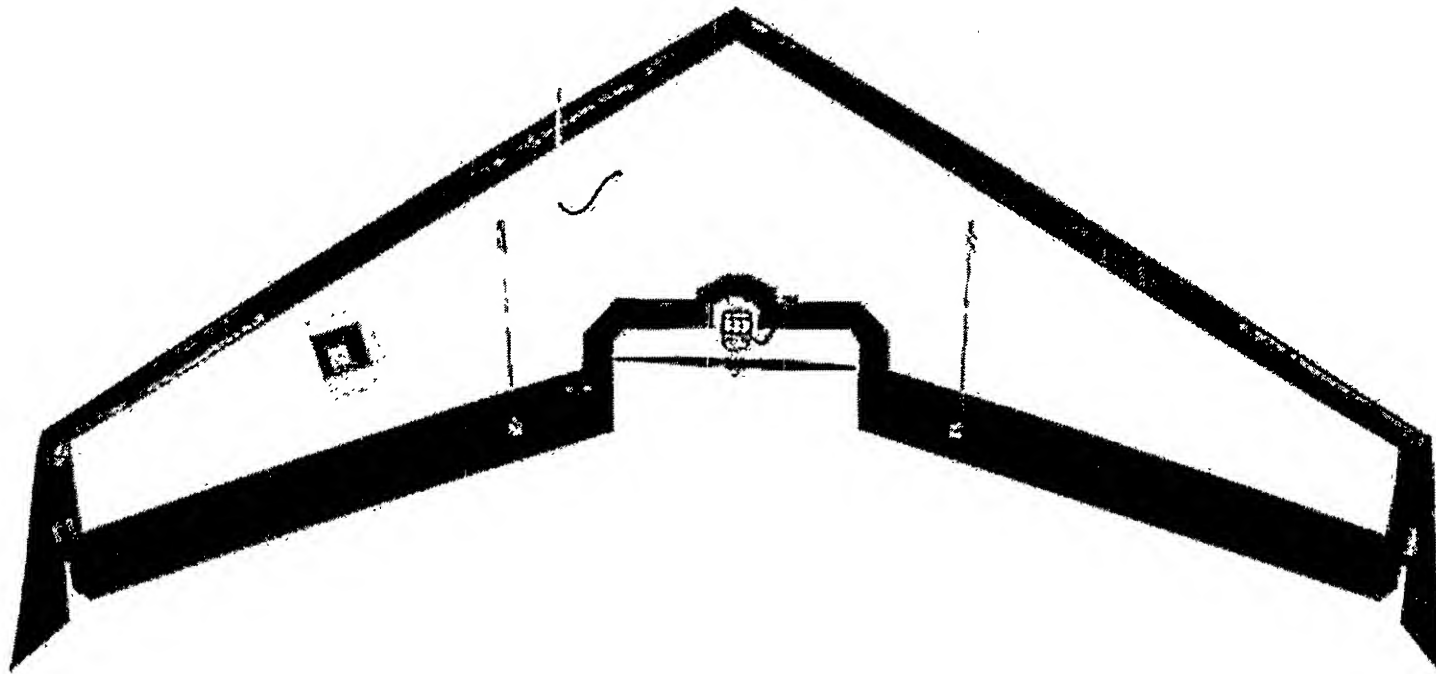


UAS Specifics...



Low Cost UAS's Development

- **Project Description:** A continuing effort to develop complete UAS's for less than \$10K. Current systems cost from \$25K to \$26M.
- **Deliverables & Schedule:** Prototype UAS's for testing and evaluation.
- **Future Work via solicitation:** FY'11





UAS Technical Bulletin



Department of Justice

Office of Justice Programs



National Institute of Justice
National Law Enforcement and Corrections Technology Centers:
Border Research Technology Center

Technical Bulletin: Law Enforcement Use of UAS 10/10/2007

IMPORTANT INFORMATION FOR LAW ENFORCEMENT: **CONSIDERATIONS PRIOR TO THE PURCHASE AND/OR OPERATIONS OF UNMANNED AIRCRAFT SYSTEMS (UAS)**

Unmanned Aircraft Systems (UAS), also known as UAVs, is a rapidly emerging technology that has exceptional appeal to law enforcement. A UAS consists of an unmanned aircraft, an aircraft control station, and command and control links. UAS are considered as aircraft. These aircraft can often be flown autonomously and at great distances from the command station. In addition, these aircraft can be very small, under 25 lbs and still carry enough equipment to provide video downlink capabilities.

The operation of a UAS by a public agency, whether it is Federal, State or Local Law Enforcement, is enforced by FAA regulations and Federal statutes. With the increase in use of UAS by the military in overseas operations, there has been a significant increase in the number of vendors both producing and marketing these same units to law enforcement. Prior to purchasing or leasing a UAS please consider the following:

- ✓ For a public aircraft operation, the FAA holds the position that a Certificate of Authorization (COA) is required to operate UAS in the National Airspace;
- ✓ The FAA has stated publicly that COAs would not be issued for use of a UAS over populated areas, such as may be defined by the yellow areas on aviation sectional (aviation map). This includes most cities and densely populated areas;
- ✓ The FAA will consider issuing a COA for operations in unpopulated areas as long as the agency seeking the COA can demonstrate that the operation is safe, that sufficient risk mitigations are in place, and the operators have sufficient training (which includes a pilot's license and medical certificate);
- ✓ Any law enforcement agency operating a UAS will be required to establish their own airworthiness for the UAS. The airworthiness establishment is the responsibility of the agency and not the vendor. Remember, any agency applying for and receiving a COA assumes liability for the entire operation. While vendor information may be used in deeming an aircraft airworthy, it should not be the only information relied upon;
- ✓ The operation of a UAS requires a FAA certified pilot with a current class II medical certificate and an observer, who while not required to be a pilot, but must have a class II medical certificate;

- ✓ A vendor approaching a law enforcement agency offering to demonstrate a UAS to an agency must have an experimental airworthiness certificate issued by the FAA prior to the flight. A vendor cannot rely upon an agency's COA to fly the aircraft. COAs are only issued for aircraft that qualify as "public" aircraft;
- ✓ The rules allowing the recreation use of model aircraft by hobbyist **DO NOT** allow law enforcement agencies to use a UAS without a COA;
- ✓ There are currently no comprehensive studies that confirm the safety records or vendor published data regarding the use of UASs. Problems identified by the military's evaluation of UAS have included radio interference, unexplained control loss, and the durability of the units for repeat flight operations. Department of Defense UAS Program Managers expressed at a recent FAA meeting on UAS, that they rarely get 10 or more missions accomplished with one UAS unit due to crashes;
- ✓ It is not anticipated that the FAA will amend their position on the operations of UAS before the year 2010. However, there are 2 key activities taking place that will push the airspace access issue forward. The first is that the FAA has agreed to conduct 2 test projects with major metropolitan police departments. One is Miami/Dade, and the other is the City of Houston. Each of these will provide valuable insight into the difficulties that may exist in operating UAS in urban environments. The other activity is the creation of new regulation for small UAS to fly in the airspace. This recent development is just starting and will be the genesis for getting small UAS flying in a majority of the US without a COA. Rulemaking can take time, however, so stick with the COA process for the next year or two.

What is the U.S. Department of Justice's doing on this issue? Through Office of Justice Programs's National Institute of Justice (NIJ) and its Aviation Technology Program, law enforcement will have the chance to voice their opinions regarding the use of UAS in the national airspace. NIJ is working with the FAA on rules and regulations regarding the use of UAS by law enforcement that both enhance the mission of public safety and provide for the safety of other aircraft in the national airspace and those on the ground. NIJ is planning a forum on the use of UAS by law enforcement with FAA participation during the winter of 2007-2008. NIJ invites interested law enforcement agencies to participate in this process. For more information on UAS operations please feel free to contact Michael O'Shea, Aviation Technology Program Manager, at Michael.OShea@usdoj.gov or Timothy Adelman Esq., the Border Research Technology Center Aviation Project Manager, at Tim@txsheriffs.org or Joe Peters, Border Research Technology Center Director at Joe@txsheriffs.org

The Office of Justice Programs provides federal leadership in developing the nation's capacity to prevent and control crime, administer justice, and assist victims. OJP has five component bureaus: the Bureau of Justice Assistance; the Bureau of Justice Statistics; the National Institute of Justice; the Office of Juvenile Justice and Delinquency Prevention; and the Office for Victims of Crime. Additionally, OJP has two program offices: the Community Capacity Development Office, which incorporates the Weed and Seed strategy, and the Sex Offender Sentencing, Monitoring, Apprehending, Registering and Tracking Office (SMART). More information can be found at <http://www.ojp.usdoj.gov>



TWG Working Requirements

A. Considerations for the Federal Government:

Establish a public use exemption for UAS subject to the following requirements:

- Aircraft weight shall not exceed *15 pounds* (micro-UAS).
- UAS Operators and observers shall demonstrate medical fitness for UAS operation via state issued motor vehicle drivers' license. Mere possession of a valid state issued drivers' license will not absolve the UAS operator and/or observer of responsibility if they are aware of or should have been aware of any medical condition that could limit their ability to safely operate and/or observe for a particular UAS mission.
- As an interim measure of proficiency, UAS Operators shall have successfully completed ground school training typically provided for persons seeking certification as sport, recreational or private pilots and must have demonstrated knowledge of airspace regulations and aircraft operational rules and characteristics.
- The U.S. Department of Justice will identify subject matter experts to work with the Federal Aviation Administration (FAA) to expeditiously develop and deploy easily accessible online course(s) designed specifically for public safety operation of UAS and include but not be limited to the requirements contained in A3 above, the successful completion of which will replace the requirement in A3 above.
- Training course(s) alluded to in A4 above shall include training on dealing with emergencies involving the use of UAS and in U.S. Constitution Fourth Amendment limitations on search and seizure.
- The FAA, in cooperation with the Public Safety user community should expeditiously establish a suite of standards to include desired operational and safety characteristics for classification of a UAS as micro-UAS. Manufacturers would then be required to certify compliance with that suite of standards prior to sale of UAS for public safety agency use and thereby eliminate the requirement to obtain Certificates of Authorization (COA) for each system deployed for public use.
- Prior to deployment within controlled airspace, the operator of a Public Use UAS shall be responsible for notifying the appropriate entity with responsibility for controlling the subject airspace of such operation; estimated duration of operation; radius of operation around given coordinates and maximum operational altitude.
- As the technologies become available, transponders or other technologies capable of transmitting a code unique to the operation of UAS or otherwise enhancing the ability of all aircraft operators to see and avoid UAS aircraft operating at or below 500 feet AGL should be required. Micro-UAS should be limited to operational altitudes at or below 500 feet vertically and 1500 feet horizontally from the control point. Pilots must maintain visual contact with UAS aircraft in order to see and avoid other aircraft or obstructions.
- Collaboration between the Departments of Defense, Justice, Homeland Security and the FAA is encouraged to expeditiously define standards testing methodology for micro-UAS designation prior to operation in the national airspace.
- A website should be developed to provide ready accessibility for public safety users of UAS to obtain the most current information regarding applicable rules, regulations, and UAS test results and to provide access to UAS user forums as may be beneficial to the public safety UAS user community.
- An aggressive outreach program should be developed to educate the potential public safety user community regarding utilization of UAS as a part of their public safety mission.



TWG Working Requirements

B. Considerations for Manufacturers of Public Use Exempted UAS:

- Aircraft component of UAS should not weigh more than 15 lbs.
- UAS, including aircraft and ground station control equipment should be easily transportable by a standard full size law enforcement equipped sedan.
- UAS aircraft should be capable of near vertical takeoff and landing to facilitate operation in dense urban environments.
- UAS aircraft should have the capability of automatically returning to the ground station in the event of loss of communications and low power condition
- UAS aircraft should have the ability to remain in flight for a minimum of three hours or have the ability to land for a rapid battery change and redeploy. Ground station equipment should be capable of controlling more than one aircraft consecutively, but not simultaneously.
- The system should have optional water and weather resistance and should be capable of operation in winds up to 20 mph.
- Float system for UAS aircraft should be an option.
- UAS aircraft should have autopilot capability.
- UAS operation should be user friendly and be capable of enroute flight planning/reprogramming.
- UAS should have GPS referenced flight recording capability.
- Video and photo target output from the aircraft should be referenced to GPS coordinates.
- Camera systems on UAS aircraft should be rapidly exchangeable and should include at a minimum, medium resolution full motion video and digital still photos, low light/night vision systems to include forward looking infrared (FLIR).
- UAS should undergo and successfully complete standards testing by an independent testing facility. Testing should include but not be limited to safety features, maneuverability, standards compliance when developed and resistance to radio frequency interference (RFI) in rural and urban environments.
- Target cost for full production run UAS is <\$25,000. Prototypes for test and evaluation should not exceed \$90,000 in costs.



TWG Working Requirements

C. Considerations for Public Safety Agencies

- Ensure that the mission at hand would benefit from UAS technology before deployment. Allow the mission to dictate the appropriate technology, resist the temptation to allow the technology to drive the mission.
- Prior to making a purchase decision, the purchasers should determine whether or not the system has successfully completed minimum standards testing. Vendors should be willing to demonstrate UAS in an operational environment in the purchaser's area of potential operations. Systems that perform well in a rural setting free of potentially harmful RFI may perform erratically or not at all in an urban environment where RFI issues are more likely to occur.
- Purchasers should take steps to ensure that control and link frequencies for UAS are legal for the proposed operation.
- Purchasers should determine from the manufacturer the estimated number of missions a particular system is capable of performing prior to requiring replacement of major components such as the aircraft itself or control station equipment. Determine replacement costs of major components in the event of physical damage or loss.
- UAS operators and observers will require initial training and on-going proficiency training in order to help ensure safe and efficient operation. Agencies contemplating purchase and deployment of UAS should be prepared to commit the necessary time and resources to achieve this training and proficiency maintenance.
- Each Public Safety agency contemplating a UAS mission should employ adverse risk assessment for every mission. Are the winds too strong? Is the rain too heavy? Is the launch and recovery space adequate? Have the pilot and observer been adequately trained and have they demonstrated proficiency in UAS operation? Is radio frequency interference going to be an issue in the mission area?
- Public Safety agencies utilizing UAS should be encouraged to share experiences with the larger UAS Public Safety user community, including safety issues and other unique problems encountered during training and/or missions.
- Public Safety agencies should be cognizant of the fact that safe and effective UAS operations are paramount to the success of their operations and public acceptance of the technology.



Small UAS Standard Test Methods

Collaborators:

U.S. Department of Homeland Security
-Science and Technology Directorate
-Test and Standards Division

U.S. Department of Commerce
-NIST Intelligent Systems Division

U.S. Navy
-Naval Air Warfare Center
-Pax River Naval Air Station Maritime UAV
Development Operations Test Team

U.S. Department of Justice
-NIJ's Office of Science and Technology
-NLECTC

Sheriffs' Association of Texas
- Border Research and Technology Center

DRAFT EXCERPTS TEST SCOPE + METHODOLOGIES

Table 1

Tests Phases and Objectives

Phase	Event #	Description	Objective	Type
I	Ground Checks			
	1	System Deployment	Determine the speed in which the system can be deployed.	Quantitative
	2	System Inspection	Mechanical and Electrical inspection of aircraft and ground systems.	Qualitative
	3	EMV / EMC	Evaluate the system in the intended environment.	Quantitative
	4	Data Links	Evaluate the quality of the data link.	Quantitative
	5	Failure Modes	Determine which on-board sensor failures cause degraded modes of flight. (GPS, Engine, Gyro, Compass, etc.)	Quantitative
	6	Flight Sensors, avionics	Determine accuracy of on-board command and control sensors (Air Speed, Altitude, Gyro, Compass, etc.)	Quantitative
	7	Loss of Link	Determine vehicle response to a loss of command and control link.	Quantitative
	8	Fuel / Battery Endurance	Measure the aircraft propulsion / sensor endurance.	Quantitative
	9	Fight Termination	Determine flight modes that cause fight termination. Verify functionality of commanded flight termination sequences.	Quantitative
	10	Displays	Evaluate the ground control station displays for relevant data.	Qualitative
	11	Mission Planning	Evaluate ease of mission planning.	Qualitative
	12	Environmental	Evaluate system in various environmental conditions.	Qualitative
II	Flight Evaluation / Day Operations			
	1	Launch Performance	Measure or evaluate launch characteristics. Area required, hazards to personnel etc.	Qualitative/Quantitative
	2	Manual FO & P	Perform basic maneuvers.	Quantitative
	3	Semi Autonomous Flight	Demonstrate semi-autonomous mode of flight.	Qualitative
	4	Autonomous Flight	Demonstrate autonomous modes of flight, airspeed, altitude, heading, waypoint navigation and station keeping.	Qualitative/Quantitative
	5	Recovery Performance	Measure or evaluate recovery characteristics.	Qualitative/Quantitative
	6	Vehicle Performance	Range, Endurance, Altitude, Speed, Climb rate.	Quantitative
	7	Lost Comms	Demonstrate lost comm. Procedures.	Qualitative
	8	In Flight Mission Changes	Re-program route.	Qualitative
	9	Collision Avoidance	Demonstrate ability to avoid obstacles.	Quantitative
	10	End User	Evaluate ease of transferring vehicle to a	Qualitative

AIR ROBOT TEST PLAN DRAFT EXCERPTS

multiple flights to demonstrate the objectives. Additional flights will be scheduled as necessary to complete the objectives. Table 4-1 contains the tests and test conditions matrix.

Table 4-1
Tests and Test Conditions Matrix

Test / Type	Objective	Airspeed (knots)	Altitude (AGL feet)	Airspace	Method	Risk Cat.
System Inspection / Ground	Mechanical and Electrical Inspection	N/A	N/A	Webster Ground	5.1.1.1	A
Avionics Test / Ground	Test on-board sensors for accuracy	N/A	N/A	Webster Ground	5.1.1.2	A
Loss of Link / Ground	Determine vehicle response to loss of link.	N/A	N/A	Webster Ground	5.1.1.3	A
Battery Endurance / Ground	Measure the system battery life.	N/A	N/A	Webster Ground	5.1.1.4	A
EMC/RF	Evaluate system in intended environment.	N/A	N/A	Webster Ground	5.1.1.5	A
Loss of Link / Flight	Verify the loss of link procedure performs as expected.	0-22	0-50	Webster ATA	5.1.3.1	A
Endurance	Measure the endurance of the aircraft.	0-22	0-50	Webster ATA	5.1.3.2	A
Low Battery Autoland	Verify the aircraft automatically lands when the battery is low.	0-22	0-50	Webster ATA	5.1.3.2	A
Launch & Recovery Performance / Flight	Confined space evaluation.	0-22	0-50	Webster ATA	5.1.3.3	A
Visual Acuity	High Rise Window Peck Evaluation / Image Stability	0-22	0-250	Webster ATA	5.1.3.4	A
Vehicle Performance	Range Evaluation and visual acuity.	0-22	0-500	Webster ATA	5.1.3.5	A
End User Evaluation	Evaluate novice operator's ability to manipulate aircraft.	0-22	0-50	Webster ATA	5.1.3.6	A

4.4 Test Loadings

One loading will be used for this evaluation. This includes the baseline aircraft, battery, and day light camera.

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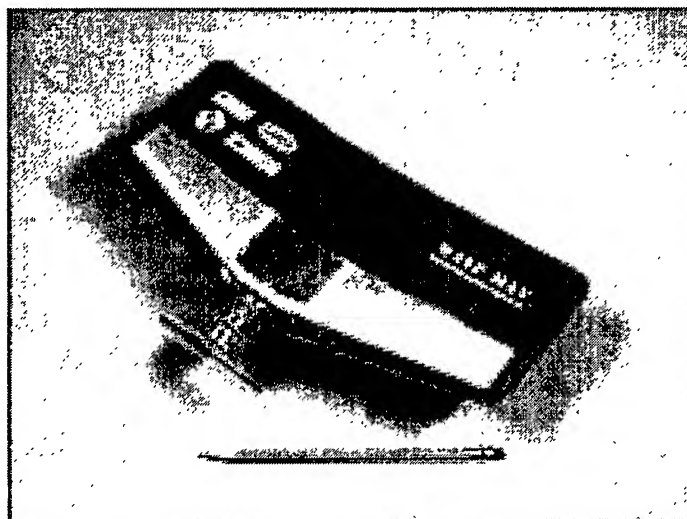


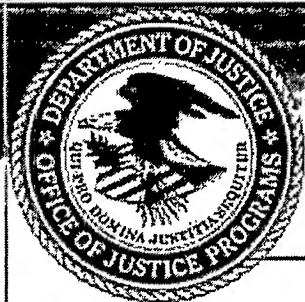


Develop Guidelines for the use of UAS by Public Safety

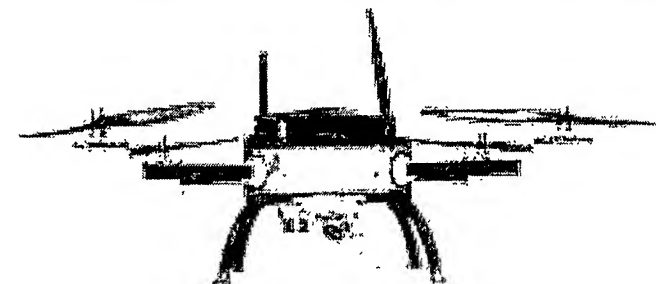
- **Project Description:** Objective is to work with interested public safety groups and the FAA to develop guidelines for the use of Unmanned Aircraft Systems (UAS) in the National Air Space (NAS) by public safety.

Met in Dec '09





Stay Tuned...



- ✓ Participated in the sUAS ARC...
- ✓ In Partnership with DHS acquire two additional UAS platforms for testing...DraganFlyer X6 and Aeryon Scout 2010 Calendar Year
- ✓ Aviation Technology Demonstration and Training Days June 9-11, 2010 Stevensville, MD (Bay Bridge Airport W29)
- ✓ UAS Public Use Partnership Consensus to the FAA Spring 2010
- ✓ Solicitations in FY '11



A Little Bit of Background Who is NIJ?

The National Institute of Justice (NIJ) is the research and development agency of the U.S. Department of Justice and is the only Federal agency solely dedicated to researching crime control and justice issues. NIJ provides knowledge and tools to meet the challenges of crime and justice, particularly at the State and local levels. NIJ's principal authorities are derived from the Omnibus Crime Control and Safe Streets Act of 1968, as amended (42 USC §3721-3722).

“An Honest Broker for Public Safety!”